

**Flashes, Behavior And Additional Species
Of Nearctic *Photinus* Fireflies
(*Coleoptera: Lampyridae*)**

JAMES E. LLOYD

UNIVERSITY OF FLORIDA

This paper reports some recent behavior observations, resurrects a LeConte species and describes two new species. Methods of study were similar to those used previously (Lloyd, 1966a, 1968); however, a different system was used to record firefly flashes. Flashes were detected by a photo-multiplier tube, transduced to a frequency-modulated audio signal that varied proportionally (9-12 kc) with light intensity, and recorded on magnetic tape (7.5 ips). For analysis, recorded tones were transduced to a variable dc voltage that was then fed into a storage oscilloscope with a calibrated time-base. The recording system was designed and built by Alton Electronics, Gainesville, Florida.

***Photinus acuminatus* Green**

This species was previously known from two specimens: male holotype, Pisgah Mt., North Carolina, and a female, Newberry, Florida. In June, 1968, I found a large population at the edge of a cypress-head in Dixie Co., Florida, near the Suwannee River, 15.3 miles S.W. of Old Town on Route 349. Flashing occurred in shrubs and small trees (willow, waxmyrtle, buttonbush).

BEHAVIOR—The behavior of this species is similar to that of other species in Division 1 (Lloyd, 1966a). Flashing activity occurs at twilight and is of short duration; the mating code is a simple flash-answer; and it seems to be a border or ecotone inhabitant. It differs from other *Photinus* in that flashing activity begins 2-7 meters above the ground in the foliage of trees and shrubs. Other nearctic *Photinus*, with the possible exception of *P. sabulosus* Green, begin activity at ground level and later in the evening (at low light intensities) a few stragglers fly at higher altitudes.

Male flashing activity began 12-16 minutes after sunset at high ambient light levels (west exposure) and terminated about 30 minutes later. The flash pattern is a single, very bright flash, estimated to be less than 0.1 sec in duration; apparently shorter than that of other nearctic *Photinus*. Flash pattern intervals were about 2 sec in duration at 74°F, although longer intervals occurred when males flew from one branch or shrub to another.

Four females were found. They were perched 1-2 meters above the ground and responded to flashes of males and a flashlight with extremely bright flashes at short time delays. The response flashes of one female were recorded: her average delay time (from the beginning of the stimulus flash) was 0.29 sec (range = 0.26-0.31, n = 20, 74°). This female emitted a double flash (Fig. 1) as oc-

asionally observed in both males and females of other *Photinus* that characteristically have single flash signals. The first flash averaged 0.08 sec in duration (range = 0.07-0.10) and the second 0.07 (range = 0.04-0.10).

The apparent ecology and distribution of this species is puzzling, for *acuminatus* is known from a cypress swamp in Florida and a boreal mountain-side in western North Carolina.

Photinus ardens LeConte, *Photinus obscurellus* LeConte

Observations on mating behavior have revealed that *ardens* and *obscurellus* are distinct species, although subsequent to naming them (1852) LeConte considered *obscurellus* a variety (1865) and then a synonym (1881) of *ardens*. *P. frigidus* E. Olivier is a synonym of *obscurellus*, and *taedifer* LeConte presumably that of *ardens* and a nomen nudum.

BEHAVIOR OF OBSCURELLUS—I have previously described the behavior of *obscurellus* under the name *ardens* (Lloyd, 1966a).

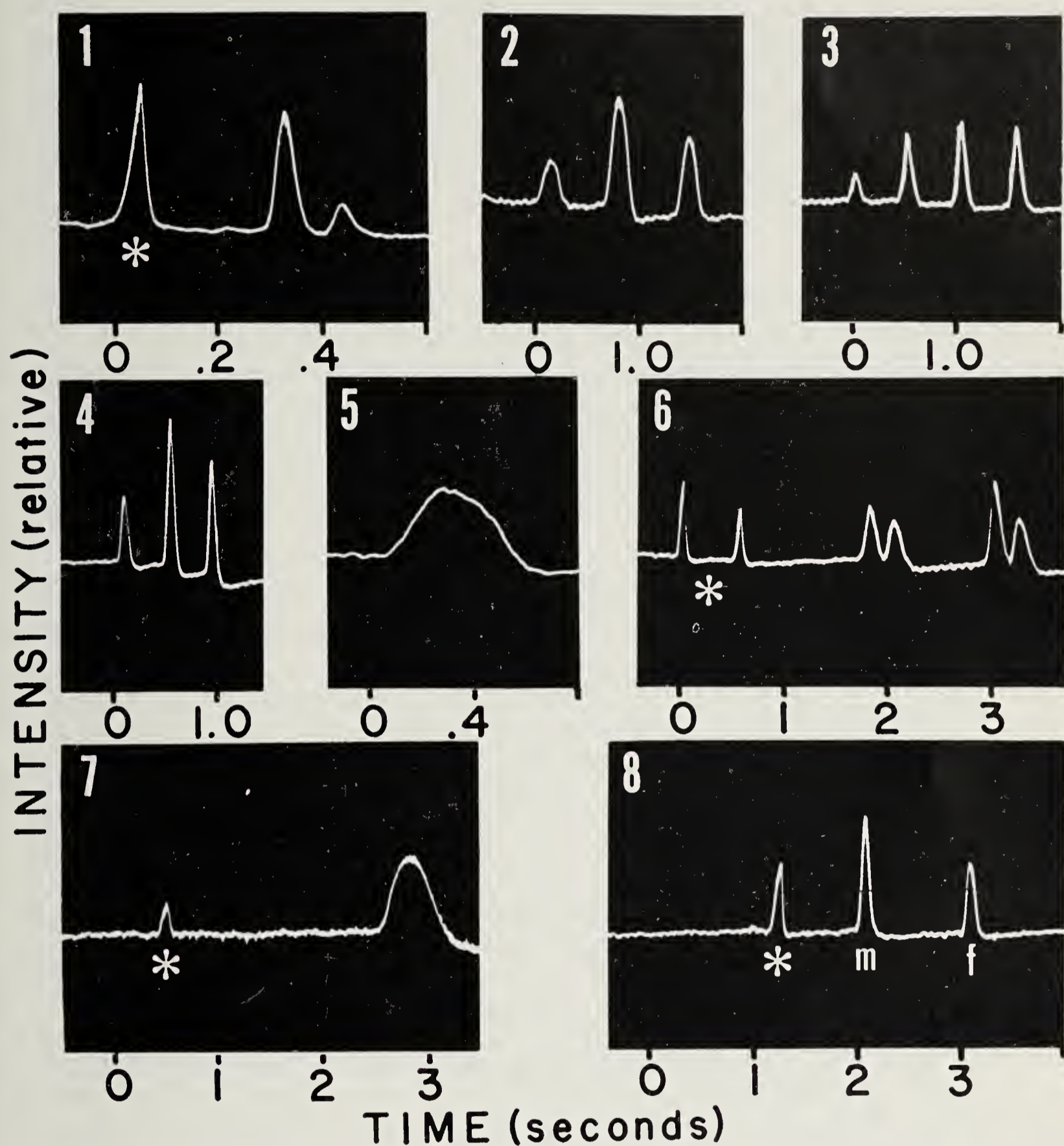
BEHAVIOR OF ARDENS—*P. ardens* was observed in marshes near Verona, Oneida Co., and Peterboro, Madison Co., and a pasture-marsh near Antwerp, Jefferson Co., New York. Its habitat is similar to that of *obscurellus*, and the latter was also seen at each of these three sites. During previous observations of *obscurellus* at several sites, *ardens* had not been seen.

Males begin flying and flashing one hour after sunset and continue for about an hour. They emit a flash pattern of two, three and rarely four pulses (Fig. 2), while flying slowly at altitudes up to three meters. Flash pattern intervals (from beginning of one pattern to beginning of next) are 10-20 sec in duration. Pulse intervals (from beginning of one pulse to beginning of next consecutive pulse) within flash patterns are from 0.66-1.0 sec at 61-66° (versus 0.43-0.6 in *obscurellus*)¹. Each pulse is 0.30-0.41 sec in duration (versus 0.18-0.22 in *obscurellus*, Figs. 3, 4) at 66°.

Females were found perched on marsh grass and shrubs. They responded to male and artificial flash patterns with a single flash (Fig. 5) at delays from 5.8-8.5 sec in duration (from the beginning of the last stimulus pulse) at temperatures from 58-65° (versus from 1-3 sec in *obscurellus*). One female occasionally emitted a two pulse response as noted in females of other *ardens*-group species (Lloyd, 1966a) but none emitted bimodal pulses as found in *obscurellus* (Fig. 6). Males of both *ardens* and *obscurellus* commonly emit phrases of four or more pulses after they have landed near answering females. Then females of *obscurellus*, but not those of *ardens*, frequently interrupt male phrases and flash a response during the males' lengthened phrase.

NOTES—The type locality of *ardens* is Lake Superior and of *obscurellus*, Missouri Territory, which existed officially from 1812-1821 (Paullin, 1932). At the time LeConte named *obscurellus* there was no official Missouri Territory. The presently known range of *obscurellus* extends into what had previously been Missouri Territory and what was in 1852, Minnesota Territory (Fig. 12).

¹The number of significant figures in pulse interval measurements varies since stopwatch and electronic readings are given together.



FIGURES 1-8.—Fig. 1. Flash response of *acuminatus* female to artificial flash (*) stimulation (74°); Fig. 2. Last three pulses of a four-pulse flash pattern emitted by perched *ardens* male (66°); Fig. 3. Four-pulse flash pattern emitted by a perched *obscurus* male (66°). Flying males emit two and three pulse phrases; Fig. 4. Three-pulse flash pattern of perched *obscurus* male (66°); Fig. 5. Flash response of *ardens* female (66°). This flash was emitted 6 sec after last pulse of artificial stimulus flash; Fig. 6. Flash response of *obscurus* female (66°). This response, composed of two doubled flashes, was stimulated by artificial flash pattern (*); Fig. 7. Flash response of *aquilonius* female to artificial flash (*) stimulation (68°); Fig. 8. Flashes of male (m) and female (f) *greeni* (75°). Flash pattern of this species is composed of two pulses. In this sequence the first pulse of the flash pattern was emitted by an artificial flasher (*).

I have examined LeConte's specimens and compared my behavior voucher specimens with them; I encountered no difficulty in associating my series with LeConte's specimens, *P. ardens* is longer (behavior voucher, \bar{x} = 11.0 mm, range = 9.7-12.0, n = 29; versus \bar{x} = 9.3 mm, range = 7.0-10.9, n = 35, in *obscurellus*). Both have brown pronotal maculae, a character known elsewhere in nearctic *Photinus* only in *P. aquilonius* n. sp. (below). In general appearance, *obscurellus* is black and *ardens* tan or dusky. Age seems not to have affected the color of the *obscurellus* type and it remains black after more than 100 years.

In museum material identified as *ardens* by Green and others there are some specimens that lack the brown pronotal maculae. Since only one of the behavior vouchers lacks this character, I believe that most of these specimens are *Photinus consimilis* Green. Nine specimens in the LeConte collection were labelled *ardens* by N. Banks (Darlington pers. comm.) and numbered 1-9. No. 1 is the *ardens* holotype (male), and No. 7 is the holotype of *obscurellus* (male). No. 2 and 5 are *ardens* females, No. 3 an *obscurellus* female, Nos. 4 and 8 males of the *consanguineus* group, No. 6 an *aquilonius* n. sp. male (below), and No. 9 a female from La. (Louisiana?), possibly a *consimilis*.

The two species may be separated with the following extension of Green's (1956) key:

28. Male flash pattern as in Fig. 4 (snappy pulses delivered briskly); interval from the first pulse of one pattern to first pulse of next pattern less than 8 seconds in duration; female delay less than 3 seconds in duration; female response-flashes bimodal (Fig. 6); elytra black with well defined yellow margins; epipleura black; each elytron without thread-like, pale, medial line **obscurellus**
- Male flash pattern as in Fig. 2 (sluggish pulses delivered leisurely); interval from first pulse of one pattern to first pulse of next pattern more than 10 seconds in duration; female delay more than 4 seconds in duration; female response-flashes unimodal (Fig. 5); elytra pale or dusky with margins poorly defined; epipleura pale or dusky with pale areas; each elytron with thread-like, pale, medial line **ardens**

Photinus consimilis Green

P. consimilis includes two morphologically cryptic species presently known as Fast-Pulse and Slow-Pulse (Lloyd, 1966a). I have observed the Fast-Pulse flash pattern in Jefferson and Oneida Cos., New York, in Alachua Co., Florida, and at the *consimilis* type locality, Roaring River State Park, Barry Co., Missouri; the Slow-Pulse species has been seen in Dade and Alachua Cos., Florida. At two sites in Alachua Co., both species have been found, and at one of these sites in the spring of 1967 a few individuals were observed emitting a flash pattern that appeared to be intermediate in pulse rate and length, and was intermediate in pulse number (4-5 versus 4-9 and 2-3). No intermediate flashers were seen in the spring of 1968 at this site. However, a large population of intermediate-flashers were seen in Leon Co., Florida, and neither the Fast nor Slow-Pulse flash-pattern was seen. Pulse number in this population was 3-4 and not 4-5 as observed in Gainesville. These intermediate *consimilis* are of considerable interest zoogeographically since they occur in a well-known area of secondary intergradation (Remington, 1968).

Photinus aquilonius Lloyd, NEW SPECIES

BEHAVIOR—A deme of this species was found in a marsh in Washtenaw Co., Michigan, and observed June 25-30, 1966. The male flash pattern is a single flash estimated to be about 0.25 sec in duration at 65°. Flash pattern intervals were variable (perhaps flashes were omitted) and ranged between 3.7 and 12.0 sec with modes at 4 sec and 6.5 sec (65-68°). Only one or two individuals could be seen at one time, and they were flying with members of at least 10 other flashing species.

Females were found perched on marsh grass and shrubs. They answered male and artificial flashes with single flashes at moderate time delays (Fig. 7).

The behavior of this species is similar to that of *ignitus* but the female delay is shorter (Fig. 10). The habitat of *P. ignitus* is pastures, hayfields, meadows and old fields although occasionally I have found individuals at marsh edges. *P. aquilonius* appears to be a marsh species since females, which presumably don't fly before mating, were commonly found on marsh plants surrounded by standing water.

Once I saw an *aquilonius* female answer the 3-pulse flash of an *obscurellus* male. He turned and flashed again; she again answered and he flew off.

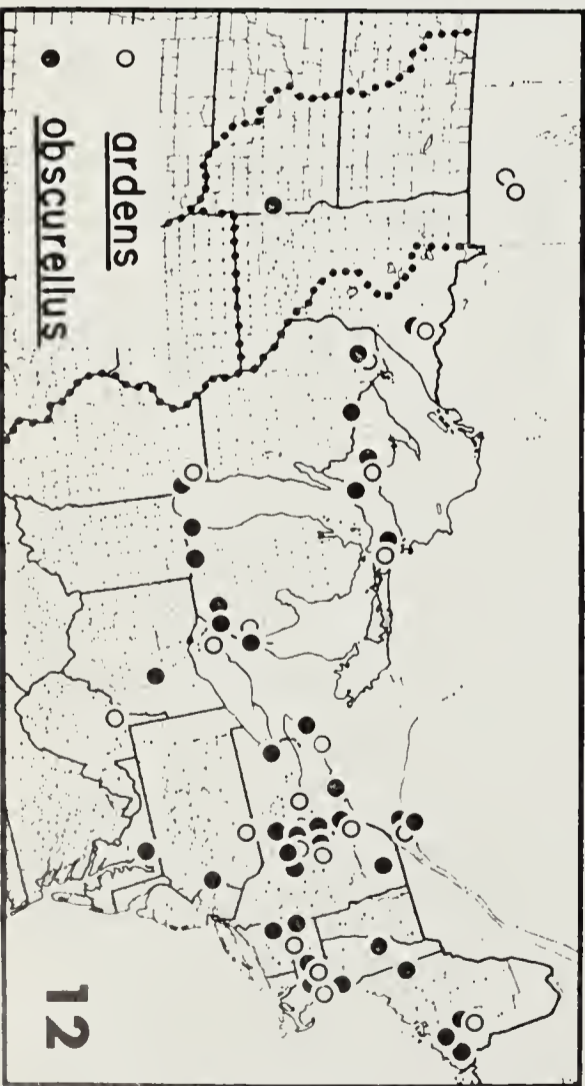
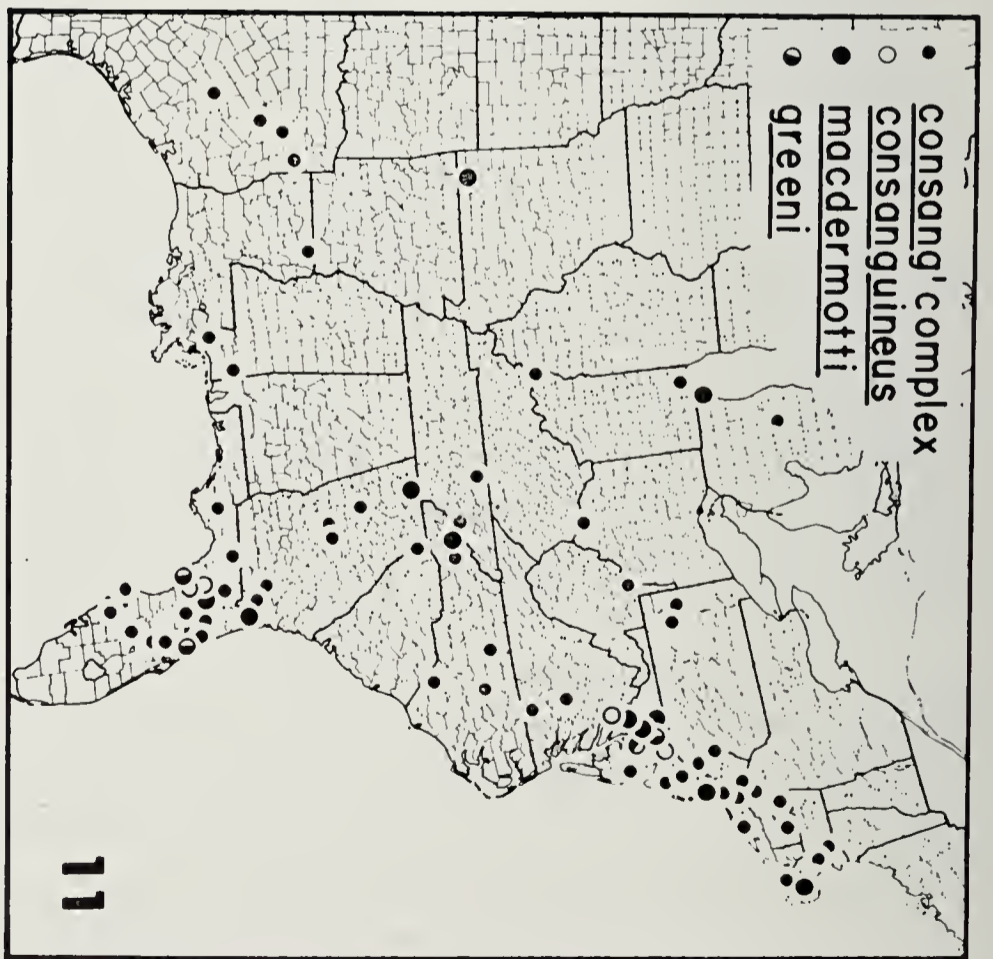
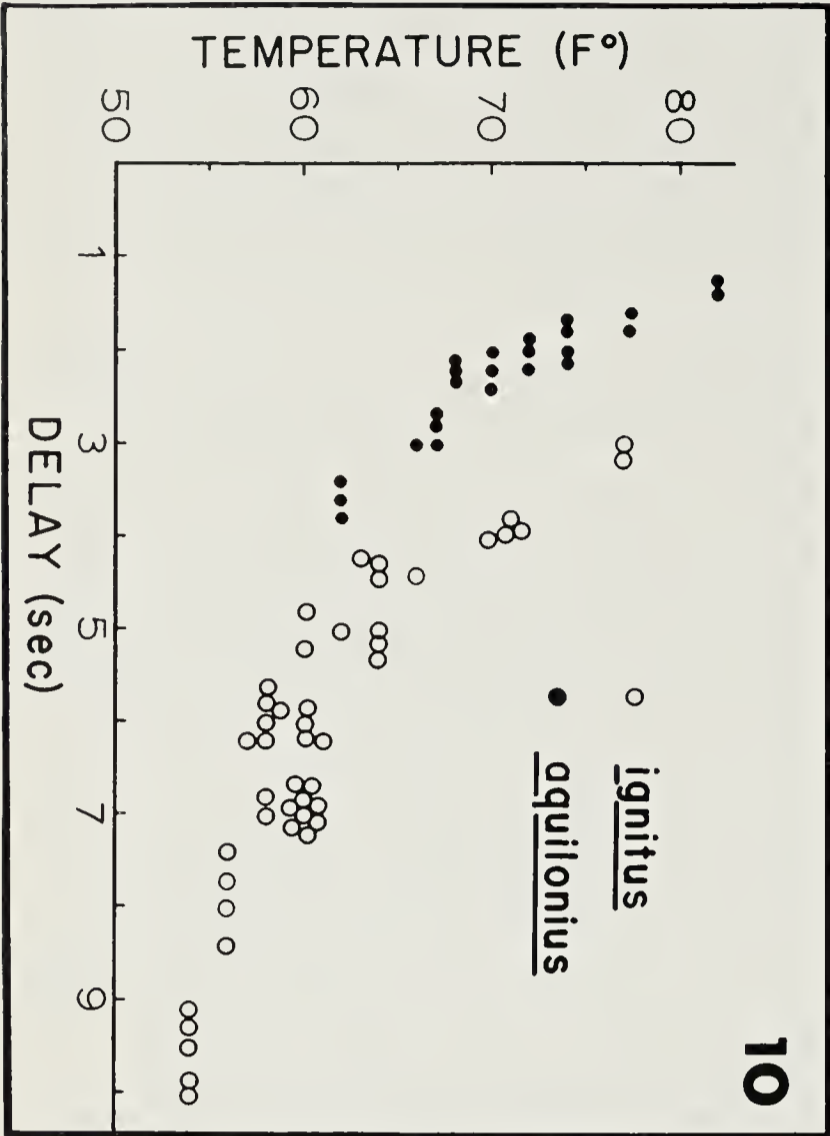
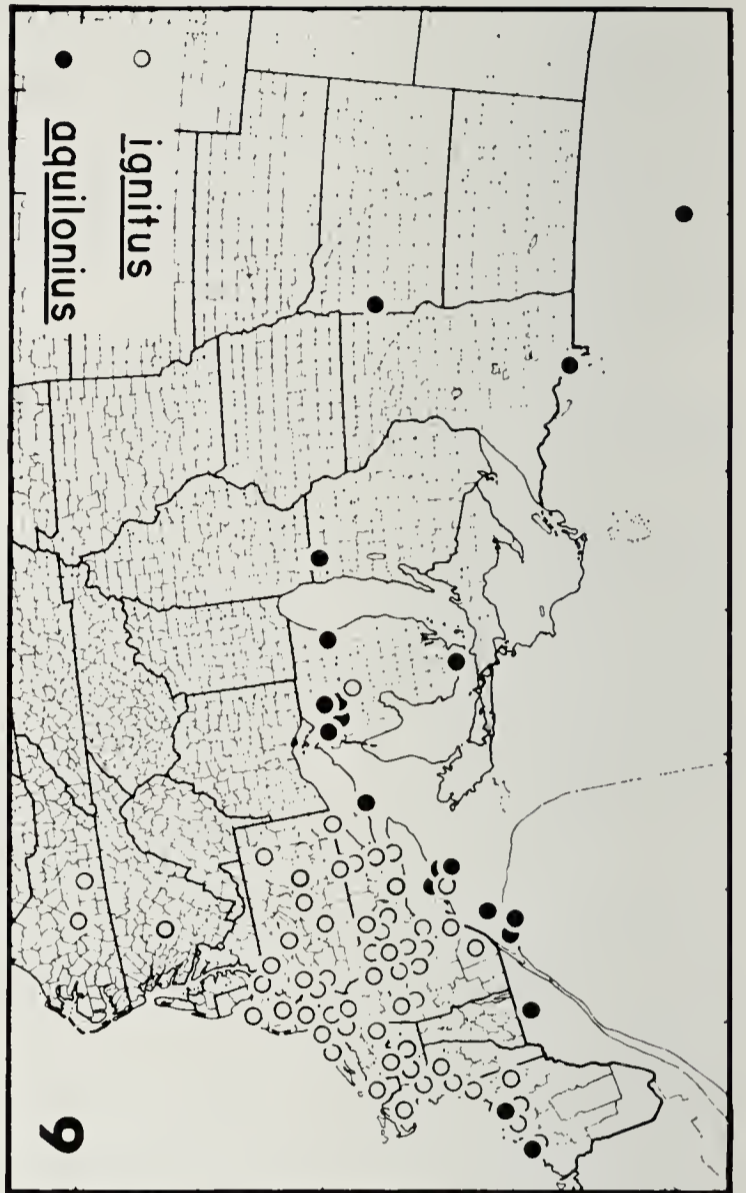
HOLOTYPE—Male. Form narrowly elongate. Length 7.4 mm. Eyes large, separated medially above by less than diameter of eye. Pronotum with disk brown, pink pigment not visible dorsally. Scutellum brown, paler at tip; mesonotal sclerites brown. Elytra brown; sutural bead pale, continuously around apex. Lateral pale elytral margin of same width as flange. Hypomera, legs and coxae brown. Thorax dark brown ventrally. Ventral abdominal segments 2-5 dark brown, 6 and 7 yellow and luminous, 8 white, translucent, and with posterior margin notched. Pygidium pale and translucent, and truncate; other tergites dark. Aedeagus as in *consanguineus* (Green, 1956, Fig. 17). Flash pattern a single moderately short flash emitted at 4-6 sec intervals.

TYPE LOCALITY—Superior Township, Washtenaw Co., Michigan, 6800 Warren Road, 27 June, 1966, J. E. Lloyd. Marsh. My No. 66390 deposited in the collection at Cornell University; C. U. Type No. 4501.

VARIATION—Length, 5.8-8.9 mm. ($\bar{x} = 7.7$, $n = 31$). Brown pigment of pronotum varying in density and distribution from barely noticeable to conspicuous and occluding completely the pink maculae of disk.

FEMALES—Length, 5.6-7.4 mm. ($\bar{x} = 6.7$, $n = 11$). Form less elongate than males'. Similar to males in color. Pink pigment of pronotum variably occluded as in males but commonly splashed upon pronotal flange. Eyes small, separated medially above by more than diameter of eye. Ventral abdominal segment 6, yellow and luminous in median two-thirds of width; segments 2-5, 7 and 8, brown. Pygidium brown and narrowly rounded. Female flash response a single flash emitted about two seconds after male flash at temperatures near 70°.

NOTES—This species is named for its northern distribution (Fig. 9). In recent observations of the fireflies of Nova Scotia, L. Buschman has observed and collected *aquilonius* and recognized it as an unnamed species, (pers. comm.). I have been unable to locate two specimens noted by Green (p. 606) from Illinois and Indiana, and the LeConte *ardens* series includes one example. *P. aquilonius* is similar to *obscurellus* and *ardens* in appearance since it has brown pronotal pigmentation, but is smaller and more narrowly elongate. Undoubtedly other specimens will be found in series now identified as *ardens*.



FIGURES 9-12.— Fig. 9. Geographic distribution of *ignitus* and *aquilonius*. *P. aquilonius* is also known from Lunenburg, Nova Scotia. *P. aquilonius* specimens were found in the following collections; CNC, UMMZ, MCZ, USNM, CNHM, CAS and L. Buschman; Fig. 10. Female delay in *ignitus* and *aquilonius*. Females were placed on warm hood of automobile or pilot light of stove for several minutes to obtain reading above 75°. The variation noted at low temperatures may be partially due to difficulties encountered in obtaining accurate temperature readings in the field and broad humidity differences; Fig. 11. Geographic distribution of members of the *consanguineus* complex. Specific determinations based on flash behavior; Fig. 12. Geographic distribution of *ardens* and *obscorellus*. Dotted lines indicate limits of former political Territories. Eastern line indicates eastern limit of Missouri Territory to 1821. Western line indicates western limit of states and organized territories when LeConte named the two species. Area north of horizontal, and the NE triangular projection (Minn.), were then included in Minnesota Territory. *P. ardens* is known also from Lunenburg, N. S., and *obscorellus* from Debert, N. S., and Terre Nueve, Newfoundland. Specimens were found in the following collections: CU, CNHM, USNM, CAS, MCZ, CNC, L. Buschman. (Note added in press: A population of *P. ignitus* has been found in Gainesville, Florida.)

Photinus greeni Lloyd, NEW SPECIES

BEHAVIOR—A few individuals of this species were found at the type locality near New Smyrna Beach, Florida, on September 18, 1967, and May 3, 1968, and near Grasonville, Maryland, June 28, 1968. Single males were seen in Baltimore Co., Maryland, and Levy Co., Florida. The Grasonville site was a mixed woods (pine, sweet-gum, sumac, oak) adjacent to a salt marsh on Cabin Creek. The dominant plants of the N. Smyrna Beach site were palmetto, wax-myrtle, and marsh-elder.

The flash pattern is composed of two pulses at intervals of about 1.2 sec (timed intervals = 1.2, 1.1, 1.3, 1.2, 1.3, 1.2, 67°, Md.). The interval between flash patterns is 4-5 sec at this temperature. Pulse duration is about 0.2 sec (75°) (Fig. 8).

Three females were found by their flashed answers to artificial flash patterns (N. Smyrna B.). At 75° female delay is about one sec (Fig. 8), similar to that of *macdermotti* and *consanguineus* females. The single male tested in the field (Md.) was attracted to a flashlight when flashed in a manner simulating the response of females.

In the laboratory, caged females (N. Smyrna B.) responded to artificial flash patterns and discriminated differences in pulse interval. Discrimination tests were similar to those previously used with *macdermotti* and *consanguineus* females (1966a). Artificial 2-pulse flash patterns with various pulse intervals were presented randomly. Intervals in the range of *consanguineus* (ca. 0.4-0.6) and of *macdermotti* (ca. 1.6-2.4) were never answered. At 74° the lower cutoff or region of ambiguity (one female) was established by several stimuli and was between 0.92 and 0.97 sec. The upper cutoff was between 1.2 and 1.3 sec. At 75-76° intervals between 0.88 and 0.93 sec were answered.

When caged males were placed so they could see artificial flashes and female responses, they would sometimes flash with the artificial light on the second pulse of subsequent flash patterns. I recorded several sequences in which the artificial flasher, a male and a female all participated (Fig. 8).

Males were not stimulated to flash when they saw artificial flash patterns without female responses but males sometimes could be stimulated to join in flashing after seeing artificial flashes that simulated male and female interactions.

HOLOTYPE—Male. Form as in *ignitus*, generally more elongate than *consanguineus* or *macdermotti* (Lloyd, 1966b). Length 6.3 mm. Eyes large, separated medially above by less than diameter of eye. Pronotum with well-defined black, median, vitta and lateral, bright pink maculae; with slight median longitudinal depression. Scutellum and mesonotal sclerites brown. Elytra black; sutural bead pale, continuously around apex; lateral pale margin wider than flange anteriorly. Coxae and legs brown, femora pale basally. Ventral thoracic segments brown. Mesepimeron and -episternum with pink and mahogany areas. Ventral abdominal segments 2-5 brown with lateral margins irregularly bordered with mahogany; segments 6 and 7 yellow and luminous, and segment 8 pale yellow and white. Pygidium brown, rounded. Aedeagus as in *macdermotti* and *consanguineus*. Flash pattern of two short flashes about one sec apart at temperatures near 70°; repeated every four to six sec of flight.

TYPE LOCALITY—One mile north Turtle Mound, Route A1A, south of New Smyrna Beach, Volusia Co., Florida, September 18, 1967, J. E. Lloyd. Sand spit; palmetto and other dense scrubby vegetation. My No. 67539. Deposited in the collection at Cornell University; C. U. Type No. 4502.

VARIATION—Length, 6.3-11.3 mm. ($n = 9$, $\bar{x} = 8.4$) Pygidium round, subtruncate or truncate. Pronotum with or without median longitudinal depression; with or without median longitudinal sulcus or carinula. Pro- and mesocoxae pale or with pale areas; hind femora brown basally. Ventral thoracic segments and sclerites without pink or mahogany coloration.

FEMALES—Length, 6.0-6.6 mm. ($n = 3$). Similar to males in form and coloration. Eyes small, separated medially above by more than diameter of eye. Ventral abdominal segments brown with pink, mahogany or tan areas. Ventral segment 6 yellow and luminous in median third of width.

NOTES—The distribution of *greeni* and other species in the complex is given in Fig. 11. *P. greeni* is named in honor of the late John Wagener Green.

LeConte named *P. consanguineus* and *P. vittiger* in 1852. Motschulsky (1854) transferred *Lampyrus vittiger* Gyllenhal (1817) to *Photinus*, thus making *vittiger* LeConte a junior, secondary homonym. *P. vittiger* Gyll. was later moved to *Pygolampis* and then to *Robopus*. Gemminger (1870) proposed the name *zonatus* to replace *vittiger* LeC. Both *vittiger* LeC. and *zonatus* have since been listed as synonyms of *consanguineus*. LeConte (1881) gave *vittiger* LeC. as a preoccupied name and synonym of *consanguineus*; he also gave *zonatus* Gemm. as a synonym of *consanguineus* and a "nomen superfluum." Green (pers. comm.) believed that LeConte gave the name *consanguineus* to replace *vittiger*. This cannot be the case since both were described at the same time (LeConte, 1852), but apparently LeConte eventually concluded that *consanguineus* and *vittiger* LeC. were not different taxa.

I have again examined the eleven specimens now in the *consanguineus* series in the LeConte collection. No. 1 is the "nomenifer" I designated previously (1966b). This is probably not the original type specimen. It is labeled "W. Va." (West Virginia?). West Virginia is not one of the "southern states," *consanguineus*' type locality, and was not established as a state until several years after *consanguineus* was named. Nos. 2-5, presumably conspecific

with No. 1, are also labelled W. Va.; 2, 3 and 5 are females and 4 is a male. No. 6 is labelled "Pen" (Pennsylvania?) and although in the *consanguineus* group, it appears to be *P. ignitus* Fall. Nos. 7, 8 and 10 are tagged with orange disks (= locality, perhaps Southern States or Texas); specimen 7 is a male and 8 a female, both presumably of the *consanguineus* complex, and specimen 10 a female and possibly *P. consimilis* Green. No. 9 is the *vittiger* type with no locality; LeConte gave Georgia as the type locality. No. 11 is a male *consimilis* from F (ort) Capron, Florida.

It is not possible to separate members of the *consanguineus* complex (*consanguineus*, *macdermotti*, *greeni*) (see below) from various localities by morphological characters, although *consanguineus* and *macdermotti* from Gainesville can be distinguished. I previously associated the name *consanguineus* with the one-half sec flash pattern (1966b) since Gainesville members of this taxon more closely resembled No. 1 of the MCZ series than did those of the Gainesville two sec flasher (*macdermotti*). The *vittiger* type specimen agrees well with the *consanguineus* nomenifer and Gainesville one-half sec flashers.

Hence, *vittiger* LeConte and *zonatus* Gemminger are considered to be a synonym of *consanguineus*; *consanguineus* is left without a formal type specimen; and determination of species in the *consanguineus* complex, in most cases, is possible only through observation of flash behavior (see below).

***Photinus macdermotti* Lloyd**

I have previously described the mating signals and behavior of this species (1966a), but in the summer of 1968 in Baltimore Co., Maryland, and Ocean Co., New Jersey, I observed behavior not seen at other localities (i. e. Georgia, Florida, Missouri, South Carolina).

The flash pattern of *macdermotti* is composed of two pulses with an interval of about 2 sec. Flash pattern interval in the southern populations is from 4-6 sec, hence the intervals between consecutive flashes (not flash patterns) would be approximately 2, 4, 2, 4, etc. sec. In the Maryland and New Jersey populations almost all individuals phrased their flashes 2, 2, 2, etc. sec. Actual measurements: male No. 1: 2.2, 2.4, 2.3, 2.4, 2.4, 2.4, 2.4, 2.4, 2.4 (72°, stopwatch); male No. 2: 1.74, 1.81, 1.78, 1.80, 1.76, 1.78, 1.77, 1.78, 1.75 (75°, electronic). The other phrasing (i. e. 2-4-2) was observed in Maryland males flying at high altitudes among tree branches after the main period of flashing activity. The flashes of some Maryland males appeared to twinkle, that is, they appeared bimodal, but this was not confirmed by electronic recording.

The female response in *macdermotti* is a single flash emitted about one second after the second pulse of a male phrase. When Maryland males received such a response from a female or an artificial light they either continued 2-2-2 or began 2-4-2 phrasing as they approached the female or decoy. Of those that began 2-4-2, when a flash response did not follow the next -2-, they continued without pause 2-2-2 until another response was flashed.

Several *macdermotti* females were collected at this site and their responses to artificial and actual flash patterns noted. In general, they flashed their species-specific response (1) after isolated single flashes that were presented at

very long intervals (1 + minutes), (2) after the species-specific pulse pair in 2-4-2 sequences, and (3) after various, sometimes consecutive, pulses of 2-2-2 sequences. These females would not answer two-pulse phrases with contained intervals of one second (*greeni* flash pattern).

Another behavioral difference noted in Maryland *macdermotti* was that male flashing activity began about 15 minutes before sunset (versus 8-12 minutes after sunset in Florida populations). This difference would appear to be larger than can be accounted for by latitudinal twilight variation or observed differences in shading or vegetation density.

While it is possible that this species is not *macdermotti* but instead a new species, the observed differences, given sympathy, would not reproductively isolate these fireflies from "typical" *macdermotti*.

TAXONOMIC NOTES AND A KEY

Green (1956) recognized five species in the *consanguineus* group; four from eastern United States and one, presumably a Mexican species, from Arizona. Since then, through behavioral studies, I have found three additional species. I have not found morphological characters that will consistently separate four of the eight species; these, *consanguineus*, *macdermotti*, *ignitus*, and *greeni*, are keyed (below) morphologically to "*consanguineus* complex," and then behaviorally to species. It is likely that there are more species in this group. McDermott (1948, p. 14) reported the presence of a single-flash "*consanguineus*" (*macdermotti*, *ignitus*?) in Wilmington, Delaware, and Martha's Vineyard, and a 2-4 pulse species in Boston. In Charles Co., Maryland, in June, 1968, I observed two individuals emitting 2-3 pulse phrases each 4-5 sec with 0.4-0.5 sec between pulses. At this same site, a ravine near the Potomac River Bridge at Rt. 301, I also observed two-pulse phrases with pulse intervals of approximately 0.7 sec (80°). Green (1956, p. 606) noted the presence of "darkly pigmented individuals . . . with the lateral pale border of the elytra narrow . . ." and also "undersized examples." Green (p. 603) also mentions a specimen labelled Sand Hills (Franklin Co.), Nebraska, that appeared much like Florida's *lineellus*; this may have been *aquilonius* n. sp. or yet another species.

KEY TO MALES OF THE CONSANGUINEUS GROUP

- | | | |
|-------|---|-----------------|
| 1. | Locality southern Arizona; lateral lobes of aedeagus tapered (Fig. 16, Green, 1956) | knulli |
| | Locality eastern and midwestern states; lateral lobes of aedeagus rounded (Fig. 17, Green, 1956) | 2 |
| 2(1). | Light organ absent (ventral abdominal segments entirely black or dark); ventral segments 6 and 7 each sub-equal in length to segment 5 ² ; eyes small, separated medially above by more than diameter of eye | indictus |
| | Light organ present (ventral segments 6 and 7 yellow); ventral segments 6 and 7 each longer than 5; eyes large, separated medially above by less than diameter of eye | 3 |
| 3(2). | Pygidium pale, sharply contrasting with preceding dark tergites | 4 |

²Ventral abdominal segment 5 = apparent segment 4 in nearctic *Photinus* except *granulatus* LeConte females.

Pygidium dark, concolorous with preceding dark tergites	5
4(3). Locality southeastern United States (Florida, Georgia, Alabama); pronotum with lateral pink or red maculae bright and conspicuous	lineellus
Locality northern United States (Michigan, Minnesota, Maine), and Canada (Fig. 11); pronotum with lateral pink or red maculae dulled or occluded by brown or dark pigment	aquilonius
5(3). Elytra brown; pronotal vitta variable, a well defined or diffuse stripe or spot, and occasionally absent; scutellum pale at tip	ignitus 6
Elytra black; pronotal vitta a vivid, shiny black stripe or rectangle and always present; scutellum black throughout	consanguineus complex..... 6
6(5). Flashes single	7
Flashes paired (though not always conspicuously so)	8
7(6). Single flash repeated each 4-6 sec ³ while flying	ignitus
Single flash repeated each 2 sec while flying (see text)	macdermotti
8(6). Two flashes of the pair not obvious or conspicuous as a pair . (The interval separating the two at least 1.6 sec in duration; consecutive flash intervals measure about 2, 4, 2, 4 etc. sec in duration) ³	macdermotti
Two flashes of the pair obvious and conspicuous as a pair . (They are emitted close together, less than 1.3 sec apart)	9
9(8). Interval between the two flashes of the pair about one-half sec in duration (consecutive flash intervals measure about 0.5, 4, 0.5, 4, etc. sec in duration)	consanguineus
Interval between the two flashes of the pair about one second in duration (consecutive flash intervals measure about 1, 4, 1, 4, etc. sec in duration)	greeni

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On *Podabrus parvicollis* Motschulsky¹ (Coleoptera: Cantharidae)

KENNETH M. FENDER

LINFIELD RESEARCH INSTITUTE

MCMINNVILLE, OREGON 97128

This is an attempt to ascertain and explain what Motschulsky had when he defined his *Podabrus parvicollis*. For some reason past students have neglected it entirely or assigned it as the synonym of the first species available, without much seeming interest in what species he actually possessed.

Motschulsky (1859) described *Podabrus parvicollis* from Pennsylvania, offering a number of salient features: Pronotum transverse, narrowed in front and margined with pale testaceous; elytra widened apically, the costae distinct; the knees yellowed on all the feet.

LeConte (1881) placed *P. parvicollis* as a synonym of *Podabrus diadema* Fabricius, with no indicated reason.

Leng (1920) followed LeConte apparently accepting his (1881) work.

Fall (1928), in a systematic review of *Podabrus*, neglected to recognize a number of names previously placed in synonymy, although he resurrected a few. Among those he neglected was *P. parvicollis*.

Green (1947) showed the impropriety of association of *P. parvicollis* with either *P. diadema* or *Podabrus planulus* Green, neither of which have ever been seen with pale knees. He apparently never pursued the problem further, sort of leaving *P. parvicollis* in the state of limbo.

As stated by Green, no specimen of either *P. diadema* or *P. planulus* has

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